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COMPANION
TO
GLAUCUS.

COMPANION TO "GLAUCUS."

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COMPANION

TO

MR. KINGSLEY'S "GLAUCUS,"

CONTAINING

COLOURED ILLUSTRATIONS

OF THE OBJECTS MENTIONED IN THE WORK,

ACCOMPANIED BY DESCRIPTIONS.

BY

G. B. SOWERBY, F.L.S.

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DOMI NUS ILLU MINA TIO MEA

ILLUSTRATED COMPANION.

BY G. B. SOWERBY, F.L.S.

ILLUSTRATED APPENDIX.

The twelve small plates which accompany the following descriptive notes, have been suggested by the fact that "Glaucus, or the Wonders of the Shore," is read by numbers of those who are not much acquainted with the objects of which the writer speaks. Pleased with passages dwelling upon the wonderful things to be found among rocks and weeds on the coast, such readers will be glad to have a few of these things placed before them in a manner enabling them to form some definite notion of what they are reading about, and what they are to look for, when wandering on the shore. The Rev. C. Kingsley has himself supplied original drawings from life of the head of the

great India-rubber worm (*Nemertes*) in the act of swallowing prey, and of the curious *Synapta digitata* (mentioned in "Glaucus," p. 74, as *Chirodota*), which is supplied not only with fingers but also with rudimentary thumbs. That gentleman has kindly added some notes on this interesting creature in describing the figures of Plate IV. With these exceptions the artist must be responsible, not only for the plates, but for the explanations which accompany them; and he wishes to express his thanks to Dr. Kingsley, of Bridgewater House, for his courtesy in permitting him the use of several microscopic preparations for Plates I. and IV. Mr. Lloyd, of Portland Road, who still flourishes as an active distributor of marine riches, has also, with his usual kindness, given opportunities to the artist of figuring and watching the habits of many of the most curious animals contained in the following Plates.

PLATE I.

ZOOPHYTA. POLYZOA. (*Glaucus, p.* 31.)

THE forms of animal life which are now united in an independent class, under the name *Polyzoa*, so nearly resemble the Hydroid Zoophytes in general form and appearance that, as the author of "Glaucus" remarks (p. 31), a casual observer may suppose them to be nearly identical. In all but the more recent works, they are treated as distinct indeed, but still included under the general term "ZOOPHYTES." The animals of both groups are minute, polypiform creatures, mostly living in transparent cells, springing from the sides of a stem which unites a number of individuals in one common life, and grows in a shrub-like form upon any submarine body, such as a shell, a rock, a weed, or even another polypidom to which it is parasitically attached. Each polype, in both classes, protrudes from and retreats within its cell by an

independent action, and when protruded puts forth a circle of tentacles whose motion round the mouth is the means of securing nourishment. There are, however, peculiarities in the structure of the Polyzoa which seem to remove them from Zoophytology to a place in the system of nature more nearly connected with Molluscan types. Some of them come so near to the compound ascidians that they have been termed, as an order, "*Zoophyta ascidioida.*"

The simplest form of polype is that of a fleshy bag open at one end, surmounted by a circle of contractile threads or fingers called tentacles. The plate shows, on a very minute scale, at fig. 1, 3, and 7, several of these little polypiform bodies protruding from their cells. But the Hydra or Fresh-water Polype has no cell, and is quite unconnected with any root thread, or with other individuals of the same species. It is perfectly free, and so simple in its structure that when the sac which forms its body is turned inside out it will continue to perform the functions

of life as before. The greater part, however, of these Hydraform Polypes, although equally simple as individuals, are connected in a compound life by means of their variously formed *polypidom*, as the branched system of cells is termed. The Hydroid Zoophytes are represented in our plate by the following examples.

SERTULARIA ROSEA. *Pl.* I. *fig.* 7. (*Glaucus*, *p.* 31.)

A species which has the cells in pairs on opposite sides of the central tube, with the openings turned outwards. In the more enlarged figure is seen a septum across the inner part of each cell which forms the base upon which the polype rests. Fig. 7 *b*, indicates the natural size of the piece of branch represented; but it must be remembered that this is only a small portion of the bushy shrub.

CAMPANULARIA SYRINGA. *Pl.* I. *fig.* 9.

This Zoophyte twines itself parasitically upon a species of Sertularia. The cells in this species are

thrown out at irregular intervals upon flexible stems which are wrinkled in rings. They consist of lengthened, cylindrical, transparent vases.

Campanularia volubilis. *Pl.* I. *fig.* 10.

A still more beautiful species, with lengthened foot-stalks ringed at each end. The polype is remarkable for the protrusion and contractile power of its lips. It has about twenty knobbed tentacula.

Polyzoa.

Among Polyzoa the animal's body is coated with a membranous covering, like that of the Tunicated Mollusca, but which is a continuation of the edge of the cell, which doubles back upon the body in such a manner that when the animal protrudes from its cell it pushes out the flexible membrane just as one would turn inside out the finger of a glove. This oneness of cell and polype is a distinctive character of the group. Another is the higher organization of the internal parts. The mouth, surrounded by tentacles, leads by gullet

and gizzard through a channel into a digesting stomach, from which the rejectable matter passes upwards through an intestinal canal till it is discharged near the mouth. The tentacles also differ much from those of true Polypes. Instead of being fleshy and contractile they are rather stiff, resembling spun glass, set on the sides with vibrating cilia, which by their motion up one side and down the other of each tentacle produce a current which impels their living food into the mouth. When these tentacles are withdrawn they are gathered up in a bundle like the stays of an umbrella. Our Plate I. contains the following examples of Polyzoa.

VALKERIA CUSCUTA. *Pl.* I. *fig.* 4.

I had an opportunity of watching a group of this beautiful species in one of Mr. Lloyd's vases. Fig. 4 *a* is the natural size of the central group of cells, in a specimen coiled round a thread-like weed. Underneath this, is the same portion

enlarged. When magnified to this apparent size, the cells could be seen in different states, some closed, and others with their bodies protruded. When magnified to 4 *d*, we could pleasantly watch the gradual eversion of the membrane, then the points of the tentacles slowly appearing, and then, when fully protruded, suddenly expanding into a bell-shaped circle. This was their usual appearance, but sometimes they could be noticed bending inwards, as in fig. 4 *c*, as if to imprison some living atom of importance. Fig. *b* represents two tentacles, showing the direction in which the cilia vibrate.

Crisia denticulata. *Pl.* I. *fig.* 5.
(*Glaucus, p.* 31.)

I have only drawn the cells from a prepared specimen. The polypes are like those described above.

Anguinaria spatulata. *Pl.* I. *fig.* 3.

So called from the resemblance of the cells on their ringed neck to the head and neck of a snake.

GEMELLARIA LORICATA. *Pl.* I. *fig.* 6.
(*Glaucus, p.* 31.)

Here the cells are placed in pairs, back to back. 6 *a* is a very small portion on the natural scale.

CELLULARIA CILIATA. *Pl.* I. *fig.* 8.
(*Glaucus, p.* 31.)

The cells are alternate on the stem, and are curiously armed with long whip-like cilia or spines. On the back of some of the cells is a very strange appendage, the use of which is not with certainty ascertained. It is a minute body, slightly resembling a vulture's head, with a moveable lower beak. The whole head keeps up a nodding motion, and the moveable beak occasionally opens widely and then suddenly snaps to with a jerk. It has been seen to hold an animalcule between its jaws till the latter has died, but it has no power to communicate the prey to the polype in its cell or to swallow and digest it on its own account. It is certainly not an independent parasite, as has been supposed, and yet its purpose in the animal

economy is a mystery. Mr. Gosse conjectures that its use may be, by holding animalcules till they die and decay, to attract by their putrescence crowds of other animalcules, which may thus be drawn within the influence of the polype's ciliated tentacles. Fig. 8 *b*, shows the form of one of these "bird's heads," and fig. 8 *c*, its position on the cell.

FLUSTRA LINEATA. *Pl.* I. *fig.* 1. (*Glaucus*, *p.* 100.)

In Flustræ the cells are placed side by side on an expanded membrane. Fig. 1 represents the general appearance of a species which at least resembles F. lineata as figured in Johnston's work. It is spread upon a Fucus. Fig. *a* is an enlarged view of the cells.

FLUSTRA FOLIACEA. *Pl.* I. *fig.* 2. (*Glaucus*, *p.* 100.)

We figure a frond or two of the common species, which has cells on both sides. It is rarely that the polypes can be seen in a state of expansion.

PLATE II.

ECHINODERMATA. CIRRIPEDIA. MOLLUSCA.

SIPHUNCULUS BERNHARDUS. *Forbes.* *Pl.* II. *fig.* 1.

I COULD not resist the temptation of figuring Mr. Lloyd's interesting specimen when the opportunity occurred, although the animal is not mentioned in Mr. Kingsley's text. The animal is common at Torquay. This specimen is living within the shell of a Turritella, just as a hermit crab lives in a whelk or periwinkle shell. But as the shell's aperture is too large for the body of the Siphunculus, it has formed a wall of sand and minute pebbles cemented together, leaving only a small hole through which it pushes out its proboscis, as represented, in search of food. This proboscis is very flexible, and is armed at the extremity with a circle of fingers round the mouth; and when any food is taken, the mouth, fingers and all, turn

inwards, and may be seen passing back through the tube till the whole proboscis disappears by inversion. Animals of this group form a passage from the *radiate* to the *annulose* forms, or, to speak more familiarly, from sea-cucumbers to sea-worms.

BALANUS PORCATUS. *Pl.* II. *fig.* 1.

On the dead Turritella are some living "acorn shells." These little "cirrhipods," or barnacles, are provided with the same apparatus for seizing prey as the Pyrgoma spoken of at p. 81 of "Glaucus." And beautiful it is to watch the symmetrical manner in which they throw out their ciliated arms and draw them back, enclosing their captured prey within a network of slender meshes.

SAXICAVA RUGOSA. *Pl.* II. *fig.* 2. (*Glaucus, p.* 99.)

It is by no means certain in what manner this bivalve mollusc eats or burrows his way into the stone in which you find him. The hole fits him so exactly, that he cannot turn round in it.

In the case of the Pholas, some naturalists suppose the burrowing to be effected by a rotatory rasping, by means of hard points or spines on the shell; but Saxicava must find some other means, either by rubbing with his tongue-shaped foot, or by secreted acids, or some unknown process. Certainly his shell, fig. 2 *a*, except in a very young state, shows no signs of a rasping apparatus. The two orifices at the double end of the proboscis are one for entrance of food-bearing currents, the other for the exit of rejectamenta.

CARDIUM TUBERCULATUM. *Pl.* II. *fig.* 3.

(*Glaucus*, *pp.* 54 *to* 61.)

This species, which should be named C. RUSTICUM, once so common at the locality described, is now, I am informed, comparatively rare, so that I have been obliged to copy the foot from a wax model. On the left of the shell will be seen protruding two ciliated tubes, whose function is the same as that of the proboscis of Saxicava.

PLATE III.

TURBELLARIA. ANNELIDA.

NEMERTES BORLASII. (*Glaucus, p.* 97.)

I WAS enabled to represent the body of this worm from a living specimen in the collection of Mr. Lloyd, although, as it was impossible to see the whole animal at once, I have shown the manner of its coiling and lying about partly from Mr. Kingsley's recollection. One peculiarity observed by that gentleman and myself was the habit of straightening out parts of its body in passing from one object to another. Fig. *b, c,* are from Mr. Kingsley's drawings, giving an enlarged view of the head; *b,* at rest; and *c,* in the act of swallowing prey.

TEREBELLA CONCHILEGA. *Pl.* III. *fig. d, e.*

Having to put some worm into the mouth of *Nemertes,* I used what may be regarded as the

end of a Terebella, although by no means characteristic, as a sort of excuse for introducing the beautiful tube of sand and bits of shell and stone which the worm builds up for a habitation. At his head are bunches of long threads which have an adhesive power; these he puts forth, and, by their means, collects his materials, drawing each thread over the edge of the already formed portion, and thus adding a bit to the wall. At the end of a tube at any given stage there are generally seen a number of smaller sand-tubes; these have probably been formed when the threads which they enveloped have been at rest, before the particles were scraped off.

PLATE IV.

Echinodermata.

Synapta digitata. (*Chirodota. Glaucus, p. 74.*)

Montagu's Chirodota of "Forbes's British Starfishes" (C. digitata, *Mont.*), was found by Mr. Kingsley washed ashore in a cave near Goȯdrington, Torquay, in large numbers after a succession of south-eastern gales. It had not been, I believe, seen in England since Colonel Montagu found it near the same place, and hasn ot been found since. A notice of it from Mr. Kingsley's specimens, may be found in Mr. Gosse's Aquarium, p. 243.

The animals were from three to six inches long, of a bright fawn brown, darker on one side than on the other, as if one side had been more exposed to light. Of their habits nothing is known, but they seem to lie embedded in soft sand, or mud, and possibly to be enclosed in a mucous case like that of Edwardsia, a cognate genus. But the

animal is especially remarkable for the ring of hands, each furnished with a thumb on the back, which surround its mouth; which are represented in the plate, fig. *a, c, d,* both of the natural size and magnified from Mr. Kingsley's original drawings. It is not known whether they take their prey by mechanical prehension, by ciliary action, or some method allied to that of the tentacula of Sagartia and Bunodes; but the live animal continually curves them down to its mouth, generally in alternate pairs.

The animals broke up into pieces by constriction, as represented in the plate, fig. *b*, after a few hours' exposure to light. White filaments, seemingly similar to those of Sagartia, were abundantly discharged from the points of division, as in the plate.

The skin abounds in anchor-shaped spiculæ (*e* and *f*), nearly similar to those of the obscure Synapta Baltica (or vittata), which may be seen in some collections of microscopic objects; and also in flat cribriform plates (*g*), furnished with a curious

cross-bar at one end. These are analogous to the cribriform plates in the skin of Cucumaria; and are, it would seem, the lowest types of that dermal skeleton of the true Radiata, which reaches its highest development in the Echinidæ and in the fossil Crinoidia of the old worlds.—C. K.

PLATE V.

Corals and Sea Anemones.

Caryophyllæa Smithii. *Pl.* V. *fig.* 2. *Pl.* VI. *fig.* 3. (*Glaucus, pp.* 32, 80, 82.)

The connexion between Brainstones, Mushroom Corals, and other Madrepores abounding on Polynesian reefs, and the "Sea Anemones," which have lately become so familiar to us all, can be seen by comparing our comparatively insignificant C. Smithii with our commonest species of Actinia and Sagartia.

The former is a beautiful object when the fleshy part and tentacles are wholly or partially expanded. Like Actinia, it has a membranous covering, a simple sac-like stomach, a central mouth, a disk surrounded by contractile and adhesive tentacles. Unlike Actinia, it is fixed to submarine bodies, to which it is glued in very early life and cannot change its place. Unlike Actinia, its body is supported by a stony skeleton of calcareous plates arranged edgewise so as to radiate from the centre. But as we find some Molluscs furnished with a shell, and others even of the same character and habits without one, so we find that in spite of this seemingly important difference, the animals are very similar in their nature. Since the introduction of glass tanks we have opportunities of seeing anemones crawling up the sides, so as to exhibit their entire basal disk, and then we may observe lightly coloured lines of a less transparent substance than the interstices, radiating from the margin to the centre, some short, others reaching the entire distance, and arranged in exactly the same manner

as the plates of Caryophyllæa. These are doubtless flexible walls of compartments dividing the fleshy parts of the softer animals, and corresponding with the septa of the coral. Fig. 2 *b* represents a section of the latter, to be compared with the basal disk of Sagartia.

SAGARTIA ANGUICOMA. *Pl.* V. *fig.* 3, *a*, *b*.

(*Glaucus*, *p*. 54, "Pinky Pears," *and* 61.)

This genus has been separated from Actinia on account of its habit of throwing out threads when irritated. Although my specimens often assumed the form represented fig. 3, *a*, Mr. Lloyd informs me that it must have arisen from unhealthiness of condition, its usual habit being to contract into a more flattened form. When fully expanded, its transparent and lengthened tentacles present a beautiful appearance. Fig. 3, *b*, showing a basal disk, is given for the purpose already described.

BALANOPHYLLEA REGIA. *Pl.* V. *fig.* 1.
(*Glaucus, p.* 84.)

Another species of British madrepore, found by Mr. Gosse at Ilfracombe, and by Mr. Kingsley at Lundy Island. It is smaller than C. Smithii, of a very bright colour, and always covers the upper part of its bony skeleton, in which the plates are differently arranged from those of the smaller species. Fig. 1, *a*, shows the tentacles expanded in an unusual degree; 1, *b*, animal contracted; 1, *c*, the coral.

PLATE VI.

CORALS AND SEA ANEMONES.

ACTINIA MESEMBRYANTHEMUM.—*Pl.* VI. *fig.* 1, *a.*
(*Glaucus, pp.* 146-7.)

THIS common species is more frequently met with than many others, because it prefers shallow water, and often lives high up among rocks which

are only covered by the sea at very high tide; so that the creature can, if it will, spend but a short portion of its time immersed. When uncovered by the tide it gathers up its leathery tunic and presents the appearance of fig. 1, *a*. When under water it may often be seen expanding its flower-like disk and moving its feelers in search of food. These feelers have a certain power of adhesion, and any not too vigorous animals which they touch are easily drawn towards the centre and swallowed. Around the margin of the tunic are seen peeping out between the tentacles certain bright blue globules looking very like eyes, but whose purpose is not exactly ascertained. Fig. 1 represents the disk only partially expanded.

BUNODES CRASSICORNIS. *Pl.* VI. *fig.* 2.
(*Glaucus, pp.* 145-6-7.)

This genus of Actinioid zoophytes is distinguished from Actinia proper by the tubercles or warts which stud the outer covering of the animal

In B. gemmacea these warts are arranged symmetrically, so as to give a peculiarly jewelled appearance to the body. Being of a large size, the tentacles of B. crassicornis exhibit in great perfection the adhesive powers produced by the nettling threads which proceed from them.

CARYOPHYLLEA SMITHII. *Pl.* VI. *fig.* 3.

This figure is to show a whiter variety, with the flesh and tentacles fully expanded. I have never been able to see a specimen with the flesh protruded to the extent which is sometimes represented.

PLATE VII.

ECHINODERMATA. MOLLUSCA.

ECHINUS MILIARIS. (*Glaucus*, *p.* 88.)

I HAD a good opportunity of observing and representing this curious radiate animal in Mr. Lloyd's collection. Several living specimens exhibited their habits in a small jar, with pebbles at the bottom,

and in company with a living specimen of *Modiola barbata* (the bearded Mussel). They moved about with some activity, sometimes crawling up the sides of the jar, sometimes creeping over the comparatively inert mussel, and generally carrying up pebbles with which they partly shaded their bodies. At other times they would make a nest among the pebbles and cover themselves over with the larger ones, as represented at *c*. As a specimen crawled up the glass it became easy to see (fig. *b*) the expanded disks of numerous flower-like suckers, which at the end of retractile stalks (fig. *e*) are pushed out from holes through the shell in avenues or walks, called *ambulacra*. These are the locomotive organs of the animal; by them it walks along; and by their means holds on the pebbles as seen in the plate, or the sea-weeds, as mentioned in *Glaucus*, p. 88. In fig. *b* the mouth is seen in the centre, with a circle of five teeth meeting. These teeth alternately part and meet in the reception of food; they are set in a pyramidal series of plates (fig. *d*), of which they form the apex, and which

constitutes a very efficient internal grinding mill for the food. The whole body or shell of the "sea egg," or "sea urchin," is beset with spines which move on a ball-and-socket joint (fig. *f*, *g*). On the bit of shell (fig. *h*) is seen some of the balls denuded of their spines, and at the left, a part of one of the ambulacra with holes for the insertion of suckers. The shell is composed of a vast number of closely fitted plates, which increase by proportionate and simultaneous additions to the edge of each, so as gradually to expand the entire bulk. There only remains to be noticed the *Pedicellariæ* (fig. *i*), which are very minute bodies placed on moveable and flexible footstalks, between the spines of our Echinus. They appear to be in constant motion, turning about on all sides, and snapping open and shut the three plates or valves which terminate the head. Their function is not known, nor their connexion with the rest of the animal understood, yet it is now generally agreed that they are not, as at first supposed, parasitic creatures with a separate life.

Modiola barbata. *Pl.* VII.

The usual habit of this Mussel would be to bury himself more deeply in cracks of rocks, only showing the edge of his shells and the fringes of his mantle; but in the jar his position was generally as shown. Mussels attach themselves to submarine objects by a bunch of horny threads termed a *Byssus*.

PLATE VIII.

Mollusca.

Littorina littorea. *Pl.* VIII. *fig.* 1.

This well-known little Mollusk is very useful in tanks on account of his phytophagous habits. He clears away much of the accumulated vegetable matter from the sides of an aquarium. It is interesting to see a specimen with his disk towards you (as fig. 1, *a*). Just above the disk you see

the head, in front of which two lips part; something seems to roll between them, and then they close. This is again and again repeated, the animal slowly crawling along all the time, and you observe the part over which his mouth has moved cleared of the confervoid growth. On killing a periwinkle and carefully opening its head you find a spoon-shaped tongue (fig. 1, *d*), back from which proceeds a long filament, which is coiled spirally. When the tongue is magnified, it is found to be studded with oblique rows of hooked teeth, forming the rasp which we have seen rolling round and scraping the green from the glass. The coiled filament is also rasped, and forms a powerful digestive apparatus. Fig. 1, *c*, shows a horny operculum, which shuts the aperture of the shell when its animal is within.

PATELLA VULGATA. *Pl.* VIII. *fig.* 3, *a*, *b*, *c*.

Merely showing the palate, with its curiously arranged teeth.

NASSA RETICULATA. *Pl.* VIII. *fig.* 2, *a*, *b*, *c*, *d*, *e*, *f*.

(*Glaucus*, *p*. 100.)

A very active Mollusc, given here chiefly on account of the opportunity afforded by the birth of young fry in Mr. Lloyd's tanks. The *Nassa* feeds on small animalcules, for which, in aquaria, it may be seen routing among the sand and stones, sometimes burying itself among them so as only to show its caudal tube moving along between them. A pair of Nassæ in Mr. Lloyd's collection, deposited, on the 5th of April, about fifty capsules or bags of eggs upon the stems of weeds (fig. 2, *b*); each capsule contained about a hundred eggs. The capsules opened on the 16th of May, permitting the escape of rotiferous fry (fig. 2, *c*, *d*, *e*), not in the slightest degree resembling the parent, but presenting minute nautilus-shaped transparent shells. These shells rather hang on than cover the bodies, which have a pair of lobes, around which vibrate minute cilia in such a manner as

to give them an appearance of rotatory motion. Under a lens they may be seen moving about very actively in various positions, but always with the look of being moved by rapidly turning wheels. We should have been glad to witness the next step towards assuming their ultimate form, but were disappointed, as the embryos died. Fig. 2, *f*, is the tongue of a Nassa, from a photograph by Dr. Kingsley.

PLATE IX.

ECHINODERMATA. ANNELIDA.

CUCUMARIA HYNDMANNI. *Pl.* IX.

(*Glaucus, p.* 79.)

I HAVE figured in another work this species of sea-cucumber under the title of *Pentacta Pentactes,* by which name it is called by some aquarians. Mr. Kingsley, however, maintains that it is the true *Hyndmanni,* and I have a strong suspicion

that the two supposed species may be identical. The retractile suckers, arranged in five double rows along the animal's body, by means of which it creeps along, are analogous to the suckers of Echinus shown at Plate VII. The creature is very active, coiling itself prettily among weeds and stones in an aquarium, and freely putting out its beautiful coronet of branched tentacles. These surround the mouth, bending and waving towards it.

SABELLA. *Pl.* IX.

The beautiful expanded fan protruded from the tube is composed of plume-like stems, with a double row of hairs. These compose the breathing apparatus of the animal. The tube is not a shell, like that of Serpulæ, but is formed of a mucous substance of a greenish chocolate colour. After figuring the specimen at Mr. Lloyd's, I saw the magnificent group of *Sabella voluticornis* in the Zoological Gardens aquarium. In most of these the fans were rolled round in one or two coils.

Among them were some less coiled, white specimens, resembling the one I have figured : but as the fans of my specimen were only slightly spiral, I do not dare to identify it as *S. voluticornis.*

Corallina officinalis. *Pl.* IX.

(*Glaucus, p.* 137.)

Behind the Sabella is the little stony plant, or pink coralline, mentioned at page 137 as formerly believed to be a coral, but now proved to be of a vegetable nature.

PLATE X.

Annelida. Mollusca.

Serpula contortuplicata. *Pl.* X. *fig.* 1.

(*Glaucus, p.* 121.)

Serpulæ are always among the most beautiful objects in an aquarium; their twisted tubes are picturesquely knotted and coiled about shells, stones, and any other submarine bodies. They

are of a shelly texture, and, like shells of Mollusca, grow by the addition of successive layers of matter on their inner edges, forming lines on the outside, called "lines of growth." When full-grown, the aperture is expanded slightly, and, in some instances, several of these expansions occur at intervals in the upper part of the tube, seeming to tell of successive intended endings of the structure. The inhabitant of this tube is an annulose worm without a distinct head, whose body is furnished along the sides with pairs of papillæ, in which are set bundles of bristles of very elaborate structure, by means of which it slowly pushes out its fan. It has another apparatus, well described by Mr. Gosse, for suddenly withdrawing when alarmed. The fan-like expansions are gills, and are beautifully feathered; when undisturbed these are nearly always exhibited, but it is astonishing how slight an alarm causes an instantaneous retreat. From this extreme sensitiveness to the mere flitting of a shadow, it is difficult to avoid the belief of *Serpulæ* being

furnished with organs of vision; none, however, have as yet been discovered. The funnel-shaped object protruding from between the fans is used as a stopper. When the fans are suddenly contracted and withdrawn into the tube, this stopper is drawn in last, and shuts the animal comfortably within its quarters. Sometimes the stopper is thrown away and a new one grows up in its place; at other times the whole worm, fans and all, jerks itself out of the tube; but then it is—to die.

Hinnites Pusio. *Pl.* X. *fig.* 1. (*Glaucus, p.* 101.)

The ground on which *Serpula* is figured is a small corner of a block of scoria in the possession of Mr. Cuming, which, having been long submerged, is covered with these pretty bivalve shells, with several species of Serpula, numerous acorn Barnacles, Terebratulæ, &c., forming a splendid group of eight or ten inches diameter. The *Hinnites* are first cousins to the *Scallops* or *Pectens*, spoken of in the text (p. 121); but

instead of being active, as scallops generally are, become, when very young, fixed to submarine substances, and live a sedentary life ever afterwards, conforming in their subsequent growth to the inequalities of their site.

Doris repanda. *Pl.* X. (*Glaucus*, *pp.* 92, 93.)

At the left corner, under the block with Serpulæ, is a white slug belonging to the order of *Nudibranchs*, or Naked-gilled Mollusca. The species is chosen for no other reason but for its suitable size in my limited plate. The white, tuberculated mantle covers nearly the entire animal, whose creeping disk or foot is seen protruding at the end. The mantle has three perforations; two in front for the pair of tentacles, and one at the back for a circular bunch of feather-like gills. The embryos of *Nudibranchs* differ only specifically from those of Nassa and other Mollusca.

EOLIS PELLUCIDA. *Pl.* X. *fig.* 2.

(*Glaucus, pp.* 92, 93.)

In this genus of Naked-gilled Mollusca, the gills are arranged along the back in the form of bunches of club-shaped papillæ. Each papilla is beautifully coloured by a central streak of pink, tipped with blue.

FISSURELLA GRÆCA. *Pl.* X. *fig.* 5.

(*Glaucus, p.* 91.)

As the "Key-hole Limpet," when compared with true *Limpets,* presents an example of very dissimilar animals provided with similar shells, there are also instances in which very similar Mollusca have very different shells, or are without them, while others are possessed of them. Thus, one common garden-slug has, under its mantle, on the *fore part* of its body a rudimentary shell, with very little form; another has none at all; and another, not so common, but still found in some gardens (the *Testacella*), has an

ear-shaped, obliquely conical shell at the *hinder part* of its foot. A garden-snail, indeed, is but a slug provided with a large spiral shell, within which it can retreat.

PHOLAS PARVA. *Pl.* X. *fig.* 4. (*Glaucus, p.* 77.)

This species receives its name from its comparatively small size. The specimen is drawn from a block of Red Sandstone in the possession of H. Cuming, Esq., which is perforated by specimens not only of this, but of the following species. The tubes, like those of other bivalve mollusca, are for entrance and exit of fluids bearing nourishment to the animal. Their orifices are guarded from any too coarse substances by a network of cilia, which are better seen in the larger species, *P. Dactylus*. The smaller disk appearing in the centre of the hiatus between the shelly valves low down is the foot, passing through the mantle. This would enable the animal to obtain a purchase on the side of its stony cell, so as to move as far

as its very limited dimensions allow; and the hole being circular, it might even turn round. But in the next species the hole is so closely fitted to the shell that not even that little privilege would be permitted. Naturalists have not yet arrived at any satisfactory conclusion as to the manner in which these boring molluscs find their way into the stones which they inhabit.

PHOLADIDEA PAPYRACEA. *Pl.* X. *fig.* 3.

This Pholas differs from the preceding and others of its family in several particulars: first, the tubes terminate in a fringed disk; secondly, there is a curious cup-shaped process at the end of the valves; and thirdly, the valves, when adult, have no hiatus in front, but are enclosed by a slender continuation of the shell, the valves meeting in the middle.

PLATE XI.

PISCES. CRUSTACEA.

SYNGNATHUS LUMBRICIFORMIS. *Pl.* XI. *fig.* 1.

(*Glaucus*, *p.* 120.)

A SPECIMEN of this pretty little Pipe-fish being in Mr. Lloyd's collection, I am glad to present a figure of him from the life, although, as Mr. Gosse observes, it is not very easy to get a fair view ot him in the tank. All his beauties cannot be seen at one time. Now, you may catch a glimpse of his prettily marbled cheek; then, while parts of his body are enveloped in a mist of uniform dulness, others may be seen exhibiting beautiful series of black and white specks symmetrically arranged. The dorsal fin is generally laid down so close on the back as to be hardly perceptible, but at other times it appears expanded, gracefully waving to assist a vertical motion. The fish is very fond of twining about among sea-weeds, frequently laying hold of the

upper stems with his *prehensile* tail while his body waves to and fro in free undulations. Altogether it is a very different creature from what might be expected from seeing the dead-stick-like dried specimens of *Pipe-fish* in museums.

PAGURUS BERNHARDUS. *Pl.* XI. *fig.* 2.
(*Glaucus, p.* 141.)

Our little friend the *Soldier Crab*, or *Hermit*, as he is variously styled, is now content with the empty shell of a periwinkle. By-and-bye, when grown larger, he will require more ample accommodation, and will then drag his heavy house about with him, in search of some small whelk-shell wherein to hide his unprotected tail. But he will be very careful to ascertain, before quitting his present shell, by feeling within the cavity of the new one, whether it is quite suitable and quite at his service. The partially developed condition of the hinder parts of a Hermit crab, their unprotected state, and the consequent necessity for an

artificial covering, are circumstances so abnormal as to have the appearance of accident. Yet they seem so constant in the various species of *Paguridæ* that they cannot be placed in that category; but must be reckoned among the mysteries of nature.

PLATE XII.

Actinioidia. Echinodermata.

Peachia hastata. *Pl.* XII. *fig.* 1.

(*Chrysanthella, Glaucus, pp.* 64-74.)

Mr. Gosse has described this from specimens sent to him by Mr. Kingsley. It is interesting chiefly as presenting characters which go to fill up a space in the system between sea-anemones on one hand, and sea-cucumbers on the other. Instead of having a walking disk like the former, it has a free termination like the latter, which has an opening. It is also described by Mr. Kingsley, who watched its habits, as "more rapid and springy" in its movements than any others of its

class. Like *Synapta* it has a tendency to transverse constriction. Its habit is to remain buried upright in sand, with its mouth and circle of tentacles just above the surface. These it retracts on the least alarm, and buries its whole body to the depth of nine inches. The colouring matter of the body appears to reside in a thin epidermis, which sometimes bursts and tears, showing a pellucid substance beneath. A small figure to the left of our Plate represents a curious clump of papillæ which projects from one side of the orifice.

URASTER RUBENS. *Pl.* XII. *fig.* 2.

(*Glaucus*, *p.* 54.)

The common Star-fish, or Cross-fish, is here represented clinging to a piece of rock by means of its numerous suckers which are arranged in double rows along a canal on the under side of each arm or finger. These are shown in the upturned corner of the nearest finger. They correspond with the walking suckers already noticed in Echinus and Cucumaria.

EXPLANATION OF THE PLATES IN BRIEF.

PLATE I. (*Glaucus, p.* 31.)

Fig. 1. FLUSTRA LINEATA. *a*, enlarged, with polypes protruding.

2. FLUSTRA FOLIACEA.

3. ANGUINARIA SPATHULATA.

4. VALKERIA CUSCUTA, enlarged; *a*, nat. size; *b*, two tentacles; *c*, tentacles bent inwards; *d*, enlarged, showing the gradual eversion of the animal.

5. CRISIA DENTICULATA, enlarged; *a*, nat. size.

6. GEMELLARIA LORICATA, enlarged; *a*, nat. size.

7. SERTULARIA ROSEA, enlarged; *b*, nat. size.

8. CELLULARIA CILIATA, enlarged; *a*, nat. size; *b*, one of the "bird's heads;" *c*, cell and bird's head, much enlarged.

9. CAMPANULARIA SYRINGA, enlarged; *a*, nat. size.

10. CAMPANULARIA VOLUBILIS, enlarged.

PLATE II.

Fig. 1. SIPHUNCULUS BERNHARDUS in shell of Turritella, with living Balani.

2. SAXICAVA RUGOSA in the stone; *a*, shell of the same. (*Glaucus, p.* 99.)

3. CARDIUM TUBERCULATUM, or RUSTICUM. (*Glaucus, pp.* 54, 61.)

PLATE III.

Fig. a. NEMERTES BORLASII; *b*, head enlarged; *c*, head expanded in the act of swallowing. (*Glaucus, p.* 97.)

d. TEREBELLA CONCHILEGA; *e*, sandy tube of the same.

PLATE IV.

Fig. a. SYNAPTA DIGITATA; *b*, the same separating, and throwing out capsuliferous threads; *c, d*, fingered tentacles, enlarged; *e*, spiculæ of S. digitata, magnified; *f*, spiculæ of "Chirodota vittata" (Synapta Baltica?); *g*, perforated plate of the latter species. (*Glaucus, p.* 74.)

PLATE V.

Fig. 1. BALANOPHYLLEA REGIA; *a*, with the tentacles expanded; *b*, animal contracted; *c*, coral. (*Glaucus, p.* 84.)

2. CARYOPHYLLEA SMITHII; *a*, animal partly expanded; *b*, section of the bony plates. (*Glaucus, pp.* 32, 80, 82.)

3. SAGARTIA ANGUICOMA; *a*, closed; *b*, basal disk showing radiating septa. (*Glaucus, pp.* 54, 61.)

PLATE VI.

Fig. 1. ACTINIA MESEMBRYANTHEMUM partially expanded: 1, *a*, closed.

2. BUNODES CRASSICORNIS. (*Glaucus, pp.* 155—7.)

3. CARYOPHYLLEA SMITHII.

PLATE VII.

Fig. a. ECHINUS MILIARIS creeping over Modiola barbata; *b*, creeping up the glass; *c*, hiding under stones; *d*, teeth and digesting mill; *e*, suckers, enlarged; *f*, a spine, enlarged; *g*, its socket; *h*, portion of the shell, denuded; *i*, Pedicellaria. (*Glaucus*, *p.* 88.)

PLATE VIII.

Fig. 1. LITTORINA LITTOREA; *a*, *b*, animal and shell; *c*, operculum; *d*, pallet; *e*, part of the same, magnified.

2. NASSA RETICULATA; *a*, animal and shell; *b*, egg capsules; *c*, *d*, fry, magnified; *e*, shell of fry; *f*, pallet, magnified. (*Glaucus*, *p.* 100.)

3. PALATE of PATELLA VULGARIS: *a*, nat. size; *b*, *c*, enlarged.

PLATE IX.

Fig. 1. CUCUMARIA HYNDMANNI. (*Glaucus*, *p.* 79.)

2. SABELLA ?

PLATE X.

Fig. 1. SERPULA CONTORTUPLICATA. (*Glaucus*, *p.* 121.)
HINNITES PUSIO, on the same block. (*Glaucus*, *p.* 100.)
DORIS REPANDA, on the left, in the lower corner. (*Glaucus*, *pp.* 92, 93.)

2. EOLIS PELLUCIDA. (*Glaucus*, *pp.* 92, 93.)

3. PHOLADIDÆA PAPYRACEA.

4. PHOLAS PARVA. (*Glaucus*, *p.* 77.)

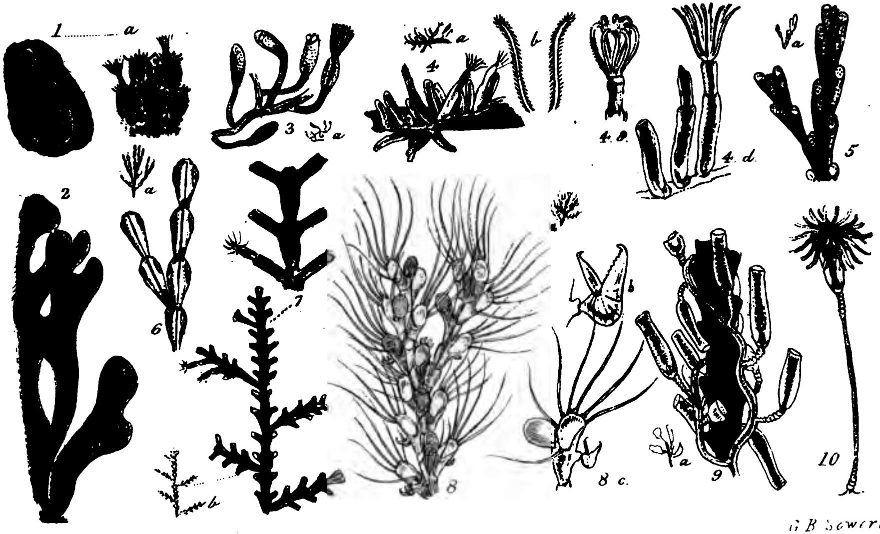
5. FISSURELLA GRÆCA. (*Glaucus*, *p.* 91.)

PLATE XI.

Fig. 1. SYNGNATHUS LUMBRICIFORMIS. (*Glaucus, p.*
2. PAGURUS BERNHARDI in a Periwinkle s
(*Glaucus, p.* 141.)

PLATE XII.

Fig. 1. PEACHIA HASTATA. (*Glaucus, pp.* 64, 74.)
2. URASTER RUBENS. (*Glaucus, p.* 54.)



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ZOOPHYTA. POLYZOA.

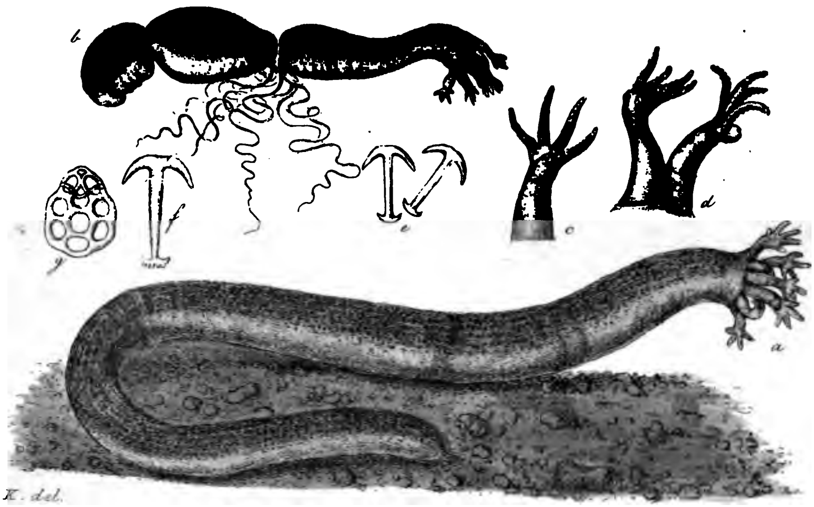
Pl. II

SIPHUNCULUS. SAXICAVA. CARDIUM.

Pl. III

C K & S B. S. del.

NEMERTES BORLASII.

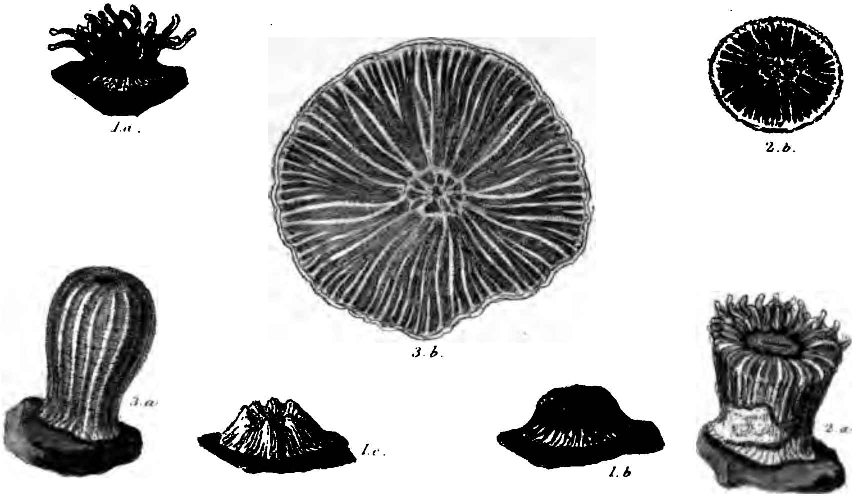


C. K. del.

SYNAPTA DIGITATA.

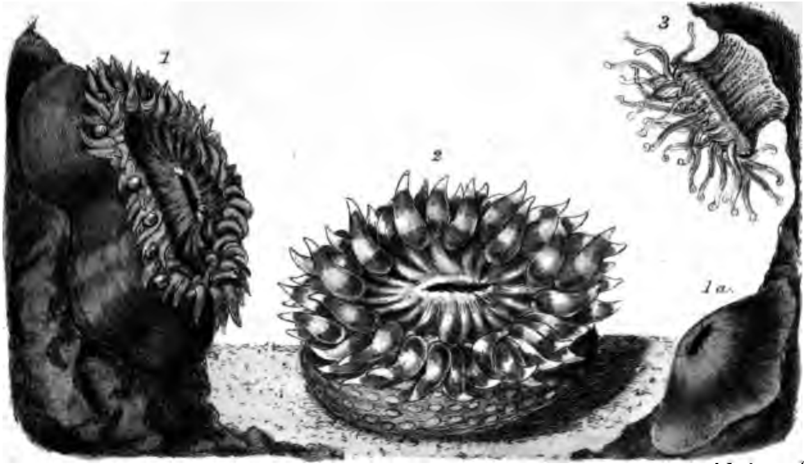
J. b. Sowerby sc.

Pl. V.



CARYOPHYLLEA. BALANOPHYLLEA & SAGARTIA.

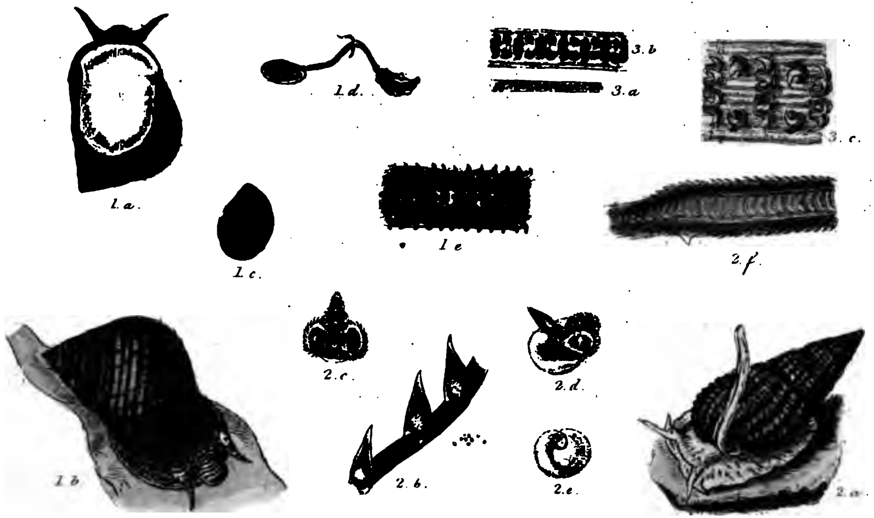
Pl. VI.



ACTINIA. BUNODES. CARYOPHYLLEA.

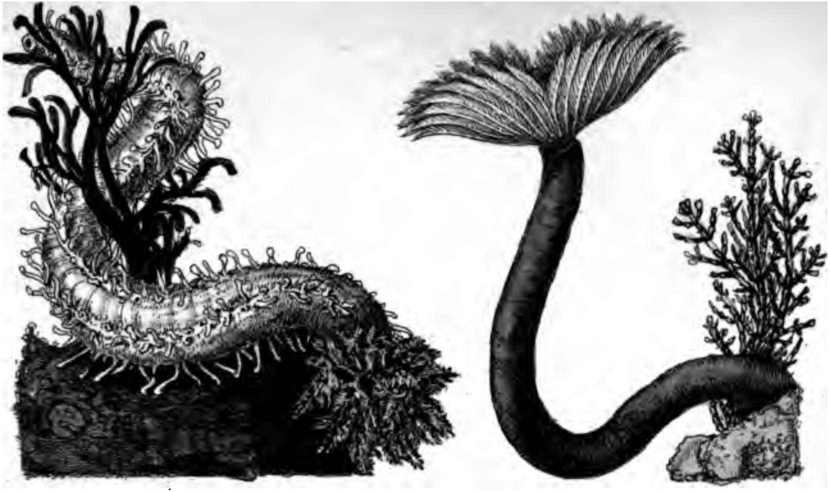
Pl. VII

ECHINUS MILIARIS.



LITTORINA AND NASSA.

Pl. IX.



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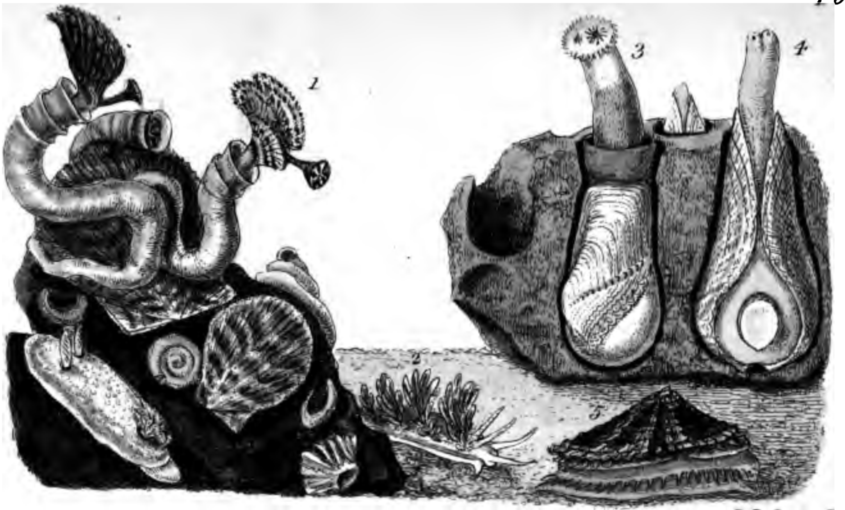
CUCUMARIA HYNDMANII. SABELLA.

Pl. X.



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SERPULA. PHOLAS. DORIS.

Pl. XI.

1. SYNGNATHUS. 2. PAGURUS.

Pl. XII.

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PEACHIA. URASTER.

BURN,
& SON
KIRBY ST